NAME________________________ Date______________

Linear Programming #2

1. In order to ensure optimal health (and thus accurate test results), a lab technician needs to give rabbits a daily diet containing a minimum of 24 grams (g) of fat, 36 g of carbohydrates, and 4 g of protein.

Rather than order rabbit food that is custom-blended, it is cheaper to order Food X and Food Y, and blend them for an optimal mix. Food X contains 8 g of fat, 12 g of carbohydrates, and 2 g of protein per ounce, and costs $0.20 per ounce. Food Y contains 12 g of fat, 12 g of carbohydrates, and 1 g of protein per ounce, at a cost of $0.30 per ounce.

What is the optimal blend?

F $8x + 12y \geq 24$ (0,2) (3,0)

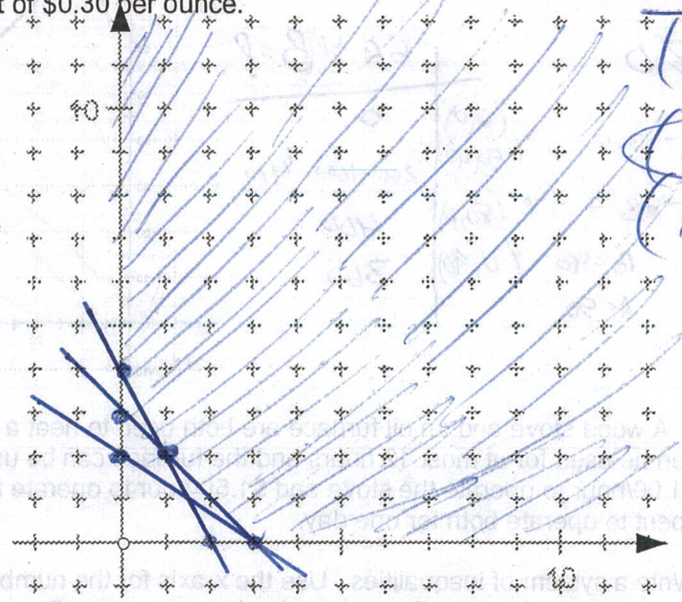
C $12x + 12y \geq 36$ (0,3)(3,0)

P $2x + 1y \geq 4$ (0,4)(2,0)

$x \geq 0$

$y \geq 0$

$.20x + .30y = C$



(0,4)	1.20
(3,0)	.60
(1,2)	.2+.6 .80

2. Space food A contains 3 calories per gram; space food B contains 4 calories per gram. An astronaut's food bar can contain no more than 30 g of space food A and no more than 20 g of space food B and can have a maximum of 110 calories.

x = A # grams of A

y = B # grams of B

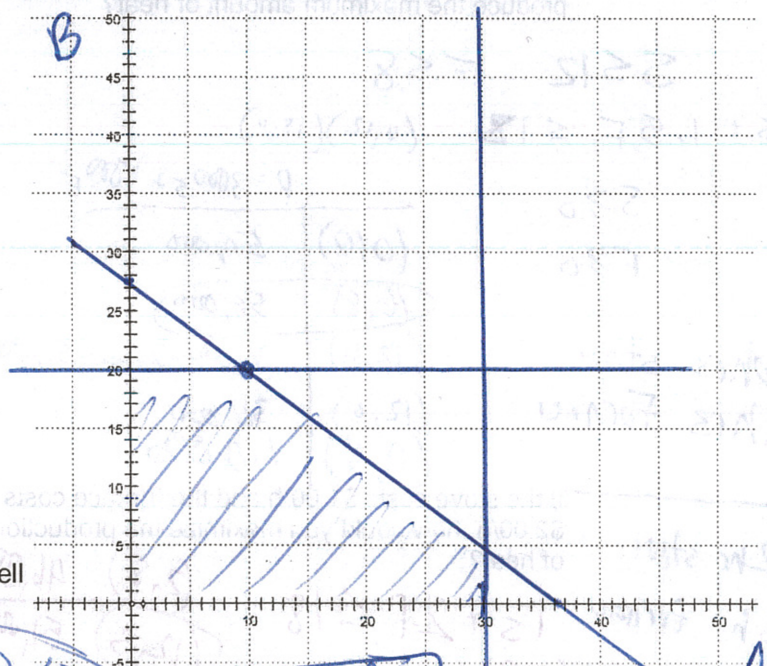
Write the inequalities defining the restrictions

$0 \leq A \leq 30$

$0 \leq B \leq 20$

$3A + 4B \leq 110$ (0 27.5) ($36\frac{2}{3}$ 0)

Graph the inequalities



Find the corner points

(0,0) (0,20) (30,0) (30,5) (10,20)

If space food A contains 10 units of protein per gram and space food B contains 20 units of protein per gram, find a function that gives the number of units of protein of x grams of food A and y grams of food B.

Evaluate this function on the corner points and tell which gives the maximum amount of protein.

P = 10A + 20B

(0,0) 0

(0,20) 400

(30,0) 300

(30,5) 400

(10,20) 500

10 grams A
20 grams B

3. An electronics company manufactures two models of smoke detectors. Model-A requires 1 unit of labor and 4 units of parts; model-B requires 1 unit of labor and 3 units of parts. If 90 units of labor and 320 units of parts are available, and if the company makes a profit of \$5 on each model-A detector and \$4 on each model-B detector, how many of each model should it manufacture to maximize its profit?

$A + B \le 90$

$4A + 3B \le 320$ $(0, 106\frac{2}{3})$ $(80, 0)$

$A \ge 0$

$B \ge 0$

$-4A - 4B = -360$

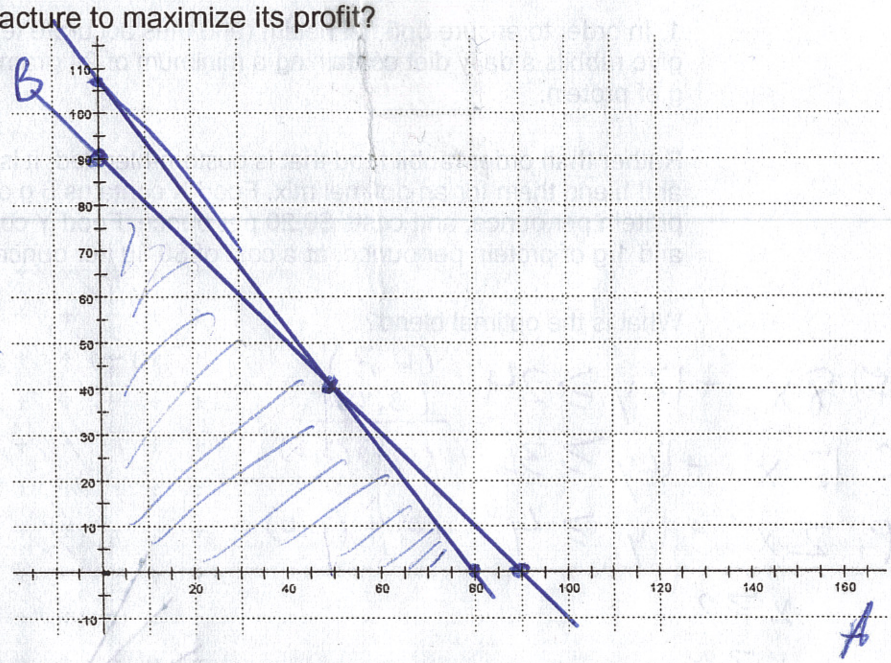
$-\cancel{8}B = -40$

$B = 40$

$A = 50$

	$5A + 4B = P$
(0,0)	0
(50,40)	250 + 160 = \$410
(80,0)	400
(0,90)	360

$\boxed{\text{50 Model As, 40 Model Bs}}$



4. A wood stove and an oil furnace are both used to heat a house. On any given day the stove can be used for at most 12 hours and the furnace can be used for at most 8 hours. It costs \$1.00/hour to operate the stove and \$1.50/hour to operate the furnace. At most \$18.00 can be spent to operate both for one day.

Write a system of inequalities. Use the x-axis for the number of hours the stove operates and the y-axis for the number of hours the furnace operates. Give the coordinates of the vertices/corner points.

If the stove produces heat at a rate of 3000 kJ/h and the furnace produces heat at a rate of 5000 kJ/h, how long should each be operated to produce the maximum amount of heat?

$S \le 12$ $F \le 8$

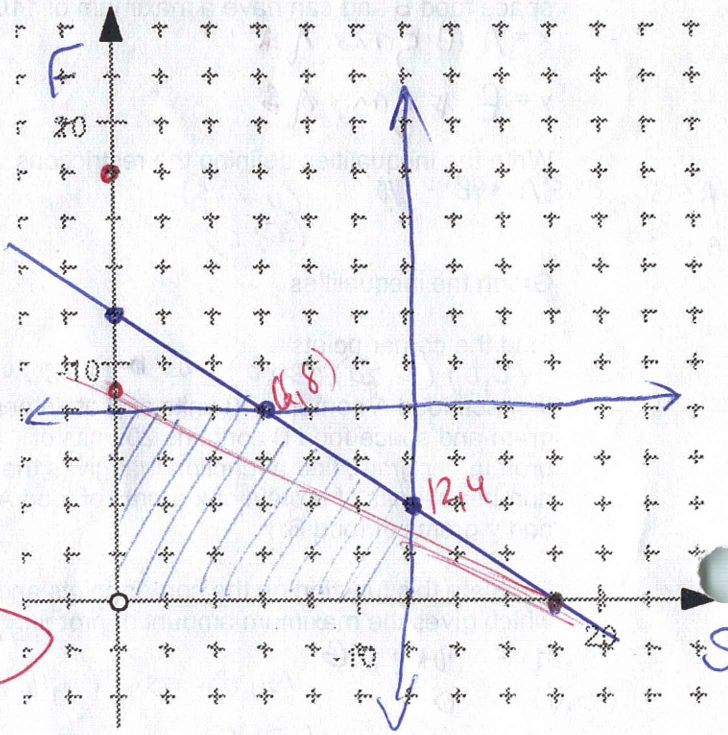
$1S + 1.5F \le 18$ $(0,12)$ $(18,0)$

$S \ge 0$

$F \ge 0$

	$P = 3000S + 5000F$
(0,0)	50,000
(6,8)	58,000
(12,4)	36,000 + 20,000 = 56,000
(12,0)	36,000
(0,8)	40,000

6hrs stove
8hrs furnace



If the stove costs \$1.00/h and the furnace costs \$2.00/h, how could you maximize the production of heat?

12 hr stove
3 hr furnace

$1s + 2f \le 18$

(0,9)
(18,0)

(2,8) 46,000
(12,3) 51,000